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Baltimore Applications Project Fourth Annual Progress Report

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Space Administration

Goddard Space Flight Center
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BALTIMORE APPLICATIONS PROJECT FOURTH ANNUAL PROGRESS REPORT

INTRODUCTION

The Baltimore Applications Project (BAP) was originally designed as a two year experimental effort to assist the government of the City of Baltimore in applying technology to the solution of municipal problems. Each year following the first two year period the Project has been extended at the request of the City. A fourth year of operation of BAP has now been completed. Details on the method of operation and significant events have been given in previous annual reports. This report discusses recent modifications in the structuring and operation of the program. A tabular update on the individual tasks undertaken and their treatment is provided in Tables 1 and 2. Details of energy related tasks are discussed in Appendix A; non-energy related tasks are discussed in Appendix B.

While a small number of problem area investigations in the first three years of BAP operation resulted in active programs within the City those early years were largely exploratory or problem identification years. The question then for the fourth year was "what is the proper next step for the project?" During the third year the BAP had been evaluated by a panel of the National Academy of Public Administration. Their recommendations provided some guidance in selecting the "proper next step" for the fourth year. During this period discussions were held with the mayors, city managers, department heads, etc. of several other smaller Maryland cities to determine if the methods of the BAP can be applied to other political environments. A new program mode was instituted, comprising the selection of a few problem areas, investigating alternative solutions in these areas in greater depth, and providing increased assistance in implementing technological solutions. Perhaps the best example of this new operating mode is the effort on the Baltimore City Fire Department's computer-aided dispatch and communication system. Details can be found in Appendix B. In addition, there was some continuation of the problem definition or needs assessment activity during this period.

During this fourth year Mr. Philip Yaffee provided assistance and advice in the study or early implementation stages of some of the BAP tasks. These included the Fire Department Dispatch and Communications System, Health Department Management Information System, Asphalt Pavement Recycling, Water Quality Monitoring/Data Collection Platform Experiment, and Digital Emergency Traffic Routing. He also served as a consultant, advisor, etc., on other tasks.

ENERGY CONSERVATION PROGRAM

As a direct result of the BAP relationship, Mayor William Donald Schaefer asked the BAP Director to consider how the energy-related problems of the city might best be addressed. Various approaches were considered. The one selected as most practical was the assignment of a full-time person to evaluate existing energy use practices and to develop or recommend energy conservation strategies and techniques. "Conservation" would be considered in the widest sense; that is, from weatherstripping and reuse of materials at one extreme, to new energy recovery techniques in solid waste disposal and the use of solar energy in city buildings at the other.

In implementing this approach the Baltimore Energy Conservation Program (BECP) was established through an Intergovernmental Personnel Act (IPA) agreement between the Goddard Space Flight Center and the City of Baltimore. It was signed by Mr. Robert E. Smylie, Deputy Director of Goddard, and Mayor Schaefer on June 29, 1977. This agreement resulted in the placement of Mr. Chesley Looney of Goddard in the Mayor's Office as Energy Coordinator and Director of BECP. With the establishment of this position and program all energy-related technology transfer effort, previously handled by the BAP, was transferred to BECP. Work performed by the BECP has not been included in this report. However, tasks relating to energy begun before the formation of BECP are discussed in Appendix A.

STATUS OF BAP ACTIVITIES

The last report cited and discussed 43 tasks. Fourteen of these tasks have been completed as far as active participation by the BAP is concerned, although several of these have now materialized into full scale city projects at this time. Thirteen other tasks have been discontinued, due for the most part to the demands of higher priority concerns of the City participants. Two new tasks have been added as indicated by asterisks in Tables 1 and 2. These tables indicate the status of the sixteen tasks in process at the time of this report.

PLANS FOR NEXT PERIOD

At the request of Mayor Schaefer, and with the approval of Mr. Smylie, the BAP has been continued for another year. During this period BAP will re-evaluate, together with the Mayor's Physical Development Coordinator and appropriate department heads, those areas of municipal activity wherein technological expertise can be applied with maximum benefit to the city. The operating mode for the fourth year will be continued, i.e., concentration on fewer projects, but in greater depth and with assistance in implementation.

The computer-aided dispatch and communication system for the Fire Department will require considerable attention by BAP. With the anticipated approval of the bond referendum by the citizens of Baltimore BAP will assist in preparing the technical portion of the request for proposal (RFP) and clarifying technical issues related to it. Assistance will also be provided in evaluating the proposals submitted by prospective contractors. Continuing consulting effort will be required during the first phase of the implementation program.

With the establishment of the Mental Health and Addiction Directorate in the Baltimore City Health Department, and with the increasing concern about information needs by the Department generally, the Health Department management information system project will become a higher priority task. Assistance will be provided to the Department in assessing its needs, providing guidelines for implementation, and developing a program plan.

In view of the combined energy conservation, raw material conservation, and environmental pollution implications of asphalt pavement recycling this area merits continuing study. The state-of-the-art in asphalt recycling will be followed and developments of possible application in the city will be brought to the attention of the Department of Public Works.

Measurements of water quality, using the Martek Mark V sensors and the Data Collection Platform in the Goddard lake, will be completed during this period. A report covering the experiment and the results obtained will be issued.

Effort on other presently ongoing specific tasks will depend upon the interest of the city and the availability of backup support at Goddard.

The applicability of the BAP technology transfer process to other governmental jurisdictions in the vicinity of the Center will receive considerable study during this period. The advisability and feasibility of entering into similar cooperative agreements with smaller cities or with local counties will be evaluated. Such an arrangement could provide benefit to the jurisdiction itself in terms of problem solving by technology transfer. It would also provide data for comparison with the Baltimore experience for evaluating the BAP technology transfer process itself.

Table 1
Higher Priority Tasks

Task Title	Status	Energy	General	Health	Management	Public Safety	Solid Waste	Water
CIP Software	4				●			
Data Collection Platform Experiment	4							●
Energy Conservative Industrial Park	E	●						
Energy Audit of Selected Buildings	E	●						
Fire Department Dispatch System	1				○	●		
Solar – Baltimore City Hospital	E	●						
Solar – Firehouse	E	●						
Solar – Upton Multi-Purpose Center	E	●						

1 – Active

3 – Completed

E – Transferred to

2 – Inactive

4 – Discontinued

Energy Coordinator

● Primary

○ Secondary

Table 2
Lower Priority Tasks

Task Title	Status	Energy	General	Health	Management	Public Safety	Solid Waste	Water
Asphalt Recycling*	1	○	●					
Digital Emergency Traffic Routing	1					●		
Health Department MIS	1			●	○			
Infrared Overflight	E	●						
Meals-on-Wheels*	3			●				
Propagation Tests	4		●					
Solar – Aquarium Heating	E	●						
Water System Simulation	2							●

*New tasks

1 – Active

3 – Completed

E – Transferred to

2 – Inactive

4 – Discontinued

Energy Coordinator

● Primary

○ Secondary

Appendix A
ENERGY TASKS

Energy Conservative Industrial Park

The concerns for energy have been transferred to the Mayor's Energy Coordinator. The activities associated with this task prior to transfer involved principally the investigation of the state-of-the-art for in situ coal gasification. Activities associated with a "cascaded energy" park were discontinued by BAP due to the impracticality of prescribing who could become a tenant, who would "stay" as a tenant and of the dependence of the whole idea on the continued park occupancy by the prime energy user. Additionally the question of who would manage the park and conceivably be responsible for consistent energy availability was a significant concern.

The technology for coal gasification is established although there is considerable new interest in improvements since the heightening of energy concerns. The idea of gasifying coal as a means of "mining the energy fraction," however, is relatively new and formative technology in the U.S. Basically the theme is to gasify western Maryland coal in the ground and develop an intrastate methane source which could be utilized by Baltimore and other Maryland industry. Through briefings by Mr. Ed. Burwell of the Department of Energy (DOE), the Mayor's Energy Coordinator along with the BAP Director and Baltimore planners were informed of the state-of-the-art of coal gasification above ground. Later the Energy Coordinator and BAP Director were briefed by personnel from the DOE In Situ Coal Gasification program.

While in situ technology development is at least five to ten years away from operational status, it was considered worthwhile to brief the coal mining people in western Maryland on the techniques and requirements of in situ operations. Such a briefing was organized and given on May 19, 1978.

Coal gasification programs of DOE are worthy of consideration by Baltimore interests. Significant benefits are derivable from having a local source of gas directly suitable for process heat for Baltimore industry. The Energy Coordinator and the City Planning Department are the principal movers for such an effort.

Energy Audit of Selected Buildings

Twelve buildings owned and operated by the City of Baltimore have been subjected to preliminary energy audits through a contract with the University of Tennessee. Individual reports on each building have been prepared and suggested changes to conserve energy have been made. As a result of the preliminary audits, several buildings are being examined preparatory to study in greater depth to effect a maximum energy saving. The entire task for Baltimore is now in the program of the Mayor's Energy Coordinator.

Solar City Hospital

There has been no further activity on this task in this interim. The task was transferred to the Mayor's Energy Coordinator with the recommendation that it be dropped.

Fire House No. 46

Costs and some associated building design changes have necessitated a major redesign for the firehouse. It is not determinable at this time whether solar can be incorporated. The City Construction Management Bureau is in charge and will make decisions regarding incorporation of solar.

Upton Multipurpose Center

The Center is under construction. Occupancy will likely occur in December. Further effort by BAP on this task is not anticipated.

Infrared Overflight

Information relative to aircraft flyover for infrared sensing of heat leaks in Baltimore buildings has been provided to the Mayor's Energy Coordinator. Consideration is underway to provide data on an experimental basis in conjunction with the Maryland Energy Policy Office.

Appendix B

NON-ENERGY RELATED TASKS

Capital Improvement Program (CIP) Software

There is no change in the inactive status of this task since the last report. Since the CIP software program appears to be moving forward under the City's own personnel, further consideration of this task will be given only on request of the City.

Data Collection Platform Experiment

The provision of high quality potable water is the prime concern of every water supplier. The ability to continually monitor the quality of the water is a critical requirement. Parameters of interest include temperature, turbidity, dissolved oxygen, pH, conductivity, heavy metals, nitrates, chlorides, etc. At the present time, Baltimore measures these parameters by having Water Treatment Division personnel physically take water samples at desired depths and locations in the reservoirs. These are then taken to the Water Treatment Laboratory for analysis.

An alternative to this manual method of sampling is the use of remote sampling and data collection via in situ sensors, with the continually-sampled data transmitted to a central monitoring and analysis facility. In November 1975, a decision was made by the Baltimore Water Treatment Division and the BAP to study the feasibility of this alternative for the Baltimore reservoirs through the use of the National Aeronautics and Space Administration's (NASA) data collection platforms (DCPs), Landsat satellites, and data processing facilities. Participating in the discussion leading to this decision were Messrs. Fred Gordon of Goddard's Missions Utilization Office (Code 902) and Charles Cote and Earle Painter of the Communications and Navigation Systems Applications Branch (Code 952) who offered their help. The Water Treatment Division was particularly interested in the possibilities of remote monitoring relative to an EPA water aeration demonstration project being considered.

During the period from November 1975 to June 1977 NASA approval of the loan of two DCPs and three sensor probes was received; DCPs and probes were transferred from Wallops Island to the Baltimore Water Treatment Division, checked out and calibrated in a cooperative effort between Goddard DCP and Water Treatment personnel, and installed in the Loch Raven Reservoir; and the data transmission link via the Landsat satellite was checked out. While successful transmission of data was achieved, some of the sensor parameter values were anomalous. Additional checkout of the DCP electronics was performed at Goddard and further sensor evaluation and calibration was done at the Water Treatment Laboratory. Based on this work it was felt that the sensors were a prime concern in arriving at a satisfactory system.

In early June 1977, through the efforts of Meredith W. Wilson, Electromechanical Branch (Code 721), a Martek Mark V water monitoring probe was obtained on loan from the National Space Testing Laboratory, Bay St. Louis, Mississippi. This probe, which measures temperature, conductivity, dissolved oxygen, and pH, was checked out, necessary modifications were made, and it was interfaced with the DCP by Messrs. Wilson and Arthur Winker, Space Environment and Simulation Branch (Code 755). In addition, a computer program was written, which converts the punch card data output of the Landsat processing facility to a formatted printout in units of measurement. An end-to-end system test indicated satisfactory operation, and arrangements were begun to return the system to Baltimore for installation in the reservoir. A meeting with the Water Treatment Division management personnel on December 8, 1977, however, determined that because of a severe manpower shortage, it would no longer be possible for them to participate in evaluating the feasibility of using the DCP and sensor probe as a water quality monitoring device.

From our experience on this project, it appears that the sensors are the weakest element in remote water quality monitoring technology. A decision was thus made within the BAP that, before terminating this project, a small amount of effort could profitably be spent in evaluating the performance of the Martek Mark V sensors, for possible future application. A wet chemistry calibration of each of the sensor probe's detectors, conducted by Dr. Michael Rock of Bowie State University under an existing support contract with Mr. Fred Gross, Materials Control and Applications Branch (Code 313), has shown that the sensor measurements are accurate, with no apparent problems with drift. Messrs. Wilson and Winker have prepared a plan for a simple, essentially unattended test of the sensor and DCP in the Goddard lake, in order to check longer term stability, need for periodic sensor cleaning, battery life, etc. This plan has been coordinated with Mr. Jacques Knox, Plant Operations and Maintenance Division (Code 290), and other appropriate groups at Goddard. The infrequent attention needed by the instruments after installation will be provided by Bowie State students under the above noted contract. Periodic water samples will be analyzed at the Water Treatment Laboratory for comparison with the remotely-sensed data.

Fire Department Communications and Dispatch System

The Baltimore Applications Project (BAP) was evaluated by a Panel of the National Academy of Public Administration and a report was issued in March 1977.¹ As a result of this evaluation, the Panel recommended that BAP become more heavily involved in the implementation stage of appropriate technology transfer projects. This recommendation has been followed in the fire department communications and dispatch system program described below.

On February 22, 1977, the Mayor's Physical Development Coordinator, Mr. Bernard Berkowitz, requested that Mr. Philip Yaffee of the BAP visit the Fire Department's Communication and Dispatch Center and observe the Center's operations. This visit showed that 1) the existing dispatch equipment was obsolete, 2) a considerable improvement in speed of response to a fire or ambulance emergency could be obtained by computerized dispatching, 3) maintenance of existing dispatching and communications equipment was difficult because replacement parts were unavailable, 4) considerable time spent in manually preparing reports could be saved by computer application, 5) the physical environment of the dispatchers was conducive to fatigue and stress because of background noise and poor lighting conditions, and 6) gaps existed in certain areas of radio communications coverage. These observations were communicated to Mr. Berkowitz for subsequent discussion with the Mayor and other concerned people.

On the basis of the apparent need for a replacement system, Mr. Yaffee contacted various fire departments throughout the country, which were using, or planning to use, computer-aided dispatch (CAD) systems. Much information was acquired dealing with the current state-of-the-art of CAD and the departments' experiences with it. A set of proposed objectives for a program for updating the Baltimore Fire Department's system was developed, together with a flow chart showing the key program elements and the organizational relationships needed to implement the program. On June 6, 1977, this information was presented to Mr. Charles Benton, Director of Finance; Mr. Calhoun Bond, President of the Fire Board; Fire Chief Thomas Burke; Mr. Berkowitz; and other interested persons, at a meeting called to discuss the feasibility of modernizing the Fire Department's communications and dispatch system. This meeting resulted in the establishment of a project team

¹ "The Baltimore Applications Project: A New Look at Technology Transfer," Report of a Panel of the National Academy of Public Administration, Dr. Ruth M. Davis, Chairperson. March 1977.

to determine the Department's requirements and to solicit competitive bid proposals from various contractors for a study of the Department's needs and the potential costs and benefits of a replacement system. The team was led by Mr. Berkowitz and included representatives of all City departments affected by the project. In addition, Mr. Yaffee and Mr. Harold Theiss (Telemetry and Computer Systems Branch, GSFC, Code 812) were included as technical consultants.

At Mr. Berkowitz's request, Mr. Yaffee developed first an outline, then a detailed draft, of a statement of work for the study contract. Five tasks were specified. Included were a complete requirements analysis, development of a conceptual system design to satisfy these requirements, a cost-benefit analysis, development of performance specifications for a recommended system, and development of an implementation plan for the program. After review and approval by the project team the statement of work was provided to the City's Bureau of Purchases for incorporation into its request for proposals to perform the study. This request (contract No. BP-78055) was issued to prospective bidders on August 2, 1977. A bidders' conference was held on August 11, 1977, and an award to Atlantic Research Corporation (ARC) was approved by the Baltimore City Board of Estimates on September 14, 1977.

During the period of performance of ARC, monthly meetings between the City's project team and ARC were held to review ARC's progress on the contract and to discuss and clarify various issues. In addition, meetings were held between Mr. Yaffee and various City personnel to resolve items of concern relative to the project and its implementation. During this period also, ARC completed its work on individual tasks, delivered reports on each of the five tasks, received comments on these reports, and made necessary changes.

At a meeting of the project team on May 4, 1978, it was agreed that ARC had satisfactorily completed the contract. Decisions were also reached on the phasing of the system's implementation, with fixed station communications to be implemented in phase one, CAD in phase two, and mobile and portable communications in phase three. The new fixed station communications equipment will operate at 154 MHz, the frequency currently used, with possible modification for 900 MHz operation when phase three is implemented, if 900 MHz portable communications equipment is available at that time. A single turn-key contractor for all three phases is the preferred mode of procurement with suitable escalation clauses to take care of the project implementation phasing. In addition, a two-step procurement process appears most suitable, the first step being that of pre-qualification of interested contractors.

At the conclusion of the May 4, 1978 meeting Mr. Arthur Hilsenrad, Assistant Director of Planning, stated that he felt that he had enough information to proceed to the next stage of the program. This is the preparation of a bond referendum package for presentation to the Baltimore citizens in November 1978. It is expected that a low level of BAP effort will be required on this program until funding approval is received by the Fire Department.

Asphalt Recycling

Highway construction and maintenance in the United States consumes tremendous quantities of aggregates, cement, and asphalt. In some parts of the country, virgin aggregates are becoming scarce and expensive. The escalating price of oil has resulted in increased cost of asphalt. The production and transportation of these materials of construction requires the expenditure of large amounts of energy. With decreasing supplies of raw materials, increasing costs, and recently-imposed

environmental restrictions which impact highway construction and maintenance, recycling techniques for asphalt pavement have begun to look increasingly attractive.

Early in this reporting period BAP was contacted by Mr. Thomas A. Considine, Chief, Technical Services Division, Department of Public Works, relative to asphalt pavement recycling for Baltimore. Mr. Considine's particular interest is in on-site surface recycling. This involves surface planing, recovery and re-processing of planed material, addition of liquid asphalt (if required), and immediate re-laying of the recycled material as a wearable surface for city traffic. Information on current recycling processes and equipment was acquired and provided to Mr. Considine. A contact was established between Mr. Considine and the representative of a foamed asphalt process developer and discussions were held on this process.

Recycling of asphalt pavement material is underway in many states, but not as an on-site process. About three-fourths of the states in the country have tried it successfully with off-site reprocessing and, having once tried it, have continued to use it. It is estimated that about two million tons of recycled material will be used in 1978. In general, this usage involves removing the deteriorated pavement from the site, re-processing it at a contractor's mixing plant, and trucking it to the job site for re-laying. The Federal Highway Administration, Demonstration Projects Division (FHA, DPD), has indicated that the State of Maryland is not among the states which are using recycled pavement materials as yet.

The City of Baltimore has had some experience with on-site recycling of asphalt pavement, using the Cutler process. This makes use of a Cutler R-1000 Repaver to perform all of the steps noted above. It was used on several repaving contracts in 1975 and 1976, but has become involved in controversy relative to competitive bidding (there being only one local contractor with such a machine) and specification changes to accommodate the use of recycled materials. FHA, DPD estimates that on-site hot mix recycling will become an accepted process in from 4 to 5 years. It will come about when the demand for recycling, based upon successful demonstrations and greater shortages, causes more manufacturers to produce the equipment needed for the process. BAP will continue to monitor this area for developments which may be of benefit to the City.

Digital Emergency Traffic Routing

The City has continued to install the new digital traffic control system during this period and there is a continuing interest in providing priority routing for emergency vehicles. No progress on this task was made by BAP during this period, however, because of the unavailability of Goddard support due to higher priority work. It is hoped that a way to provide assistance to the City on this project will be found during the next period.

Health Department Management Information System (MIS)

The Health Department Workshop, conducted by the BAP in July 1976, has been described in detail in a previous report.² Its purposes were to identify and prioritize the health needs of the city; to develop policies, goals, and structures for meeting these needs; and to explore the application of technology to the operations of the Health Department. Relative to the latter, it was decided that an automated management information system (MIS) should be studied as a tool for improving the delivery of health care services. Subsequent discussions between senior management personnel of

²Wolff, Edward A. and Thomas S. Golden, "Baltimore Health Department Workshop," July 1976, X-702-76-194, Goddard Space Flight Center, Greenbelt, Md. 20771.

the Department, participation by health personnel in a workshop on human service information systems transfer, and BAP investigation of MIS applications and experiences, resulted in the selection of the mental health area for trial MIS application. This choice was based partly on the moderate size of the mental health data base to be automated and the availability of several mental health MIS software systems with a potential for transfer to Baltimore with only minor modifications.

In April 1977 the Health Department decided to put a temporary hold on the implementation of a mental health MIS. The reasons were twofold: first, the position of Director of the Bureau of Mental Health was unfilled; and second, the Health Department was proposing a new "umbrella plan" for mental health operations. Under this plan, all Federal and State funds for mental health, drug abuse, and alcoholism services in the city would be channeled through the Baltimore City Health Department. One of the requirements of such a plan would be a centralized reporting system.

Contacts with Dr. Susan Guarnieri, Assistant Commissioner for Adult Health Services, and Dr. Mark Lipton, Assistant Commissioner for Mental Health and Addiction, in May 1978 indicate that the "umbrella plan" has now been implemented, management level positions under the plan have been filled, and organizing is under way for operations, beginning with a needs assessment of the existing Baltimore client population. Dr. Lipton is very interested in exploring the applicability of MIS to the new mental health and addiction program. We will be meeting with him and his senior staff in June to discuss the assistance which BAP could provide to the program.

Meals on Wheels

The development of balanced, shelf stable packaged meals is a by product of the food and nutrition studies for astronauts in the space program. A problem is perceived in the delivery of meals to shut-ins and other indigent parties in public service areas such as the Maryland Meals-on-Wheels (MMOW) program. Normally hot meals are delivered to these parties five days a week by volunteers through the MMOW program. No deliveries are made on weekends.

On behalf of the Meals on Wheels and the Baltimore City Health Department (BCHD) a survey of the state of development of balanced packaged meals was made to determine availability and usability of packaged meals suitable to filling the weekend (and other) need of the MMOW and BCHD activities.

It was found that a variety of balanced, shelf stable meals had been "designed" and assembled in lots large enough to prove their suitability for the purpose. There were at least two manufacturers or suppliers of these in business at the time. The missing elements seem to be money for an experiment to assess the usefulness of the idea and some social factors involving the acceptability of the meal form by the recipient and by the volunteer workers involved with meal delivery. The general willingness of the volunteers to deliver a "small cold package" as a suitable, hearty meal for their client was perceived by MMOW managers as a question to be resolved. Since the information uncovered reveals at least two suppliers of meals, the task is considered completed. However, sources of funding for supplying packaged meals for an experimental evaluation will be sought.

Propagation Tests

Due to lack of priority plans for testing the effects of high rise buildings on propagation of radio signals from satellites have been discontinued.

Water System Simulation

There has been no further activity on this task due to priority of other tasks. It will be discontinued until request for further activity by the City.

Miscellaneous

In the last annual report the status of two tasks was correctly reported in the text but incorrectly reported in Tables 1 and 2. Proper status then and now is as follows:

**Housing and Community Development Data System
Completed (3)**

**Sewer Flow Meter
Discontinued (4)**

No further effort is anticipated in these tasks unless specifically requested by the City.